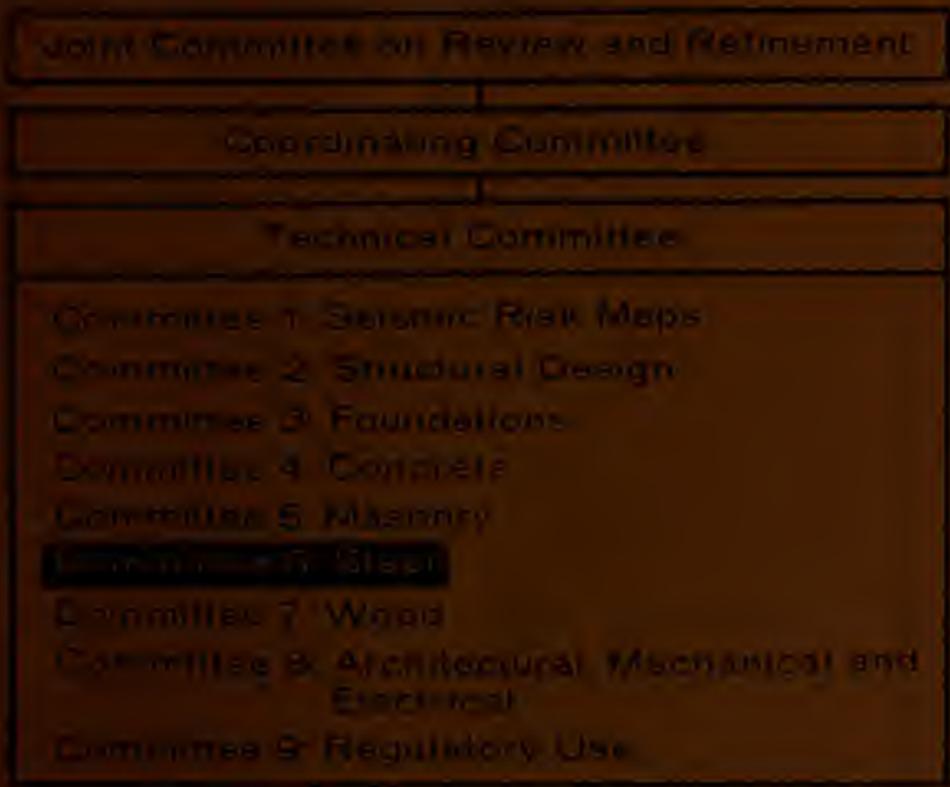




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Review and Refinement of ATC 3-06 Tentative Seismic Provisions



Report of Technical Committee 6: Steel

This report represents the recommendations of a committee on steel structures within the framework of existing seismic design criteria and the general concepts of the ATC 3-06 Tentative Provisions for Seismic Provisions for Buildings.

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REVIEW AND REFINEMENT OF ATC 3-06 TENTATIVE SEISMIC PROVISIONS

REPORT OF TECHNICAL COMMITTEE 6: STEEL

Mr. Jerry Iffland, Chairman, American Society of Civil Engineers
Dr. H. S. Lew, Secretariat, National Bureau of Standards
William A. Milek, American Institute of Steel Construction
Dr. Albert L. Johnson, American Iron and Steel Institute
Mr. John B. Scalzi, Interagency Committee on Seismic Safety in Construction
Mr. William A. Sontag, Metal Building Manufacturers Association
Mr. Norman K. Cohn, Steel Plate Fabricators Association
Mr. Clarkson Pinkham, Applied Technology Council
Mr. Charles De Maria, Building Seismic Safety Council

Prepared for use by the:

BUILDING SEISMIC SAFETY COUNCIL

Sponsored by:

FEDERAL EMERGENCY MANAGEMENT AGENCY

Center for Building Technology
National Bureau of Standards
Washington, D.C. 20234

October 1980

U.S. DEPARTMENT OF COMMERCE, Phillip M. Klutznick, Secretary
Luther H. Hodges, Jr., Deputy Secretary
Jordan J. Baruch, Assistant Secretary for Productivity, Technology,
and Innovation
National Bureau of Standards, Ernest Ambler, Director

Abstract

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the steel design provisions. The committee made 6 recommendations for revisions to the Tentative Provisions and three additional recommendations. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

Key Words: Building; building codes; building design; earthquakes; engineering; standards; steel; structural engineering.

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1.0 INTRODUCTION

1.1 General

The Tentative Provisions for the Development of Seismic Regulations were developed by the Applied Technology Council (ATC) in an effort that included a wide range of experts in the actual drafting of the provisions. Two external review drafts were circulated to a large portion of the interested and informed community of eventual users. However, because the Tentative Provisions were innovative, doubts about them existed. Consequently, an attempt was made to investigate these doubts and to improve the Tentative Provisions where possible before an expensive assessment of the Tentative Provisions was undertaken by conducting trial designs.

This review and refinement project was planned and conducted by the National Bureau of Standards with the advice and approval of the Building Seismic Safety Council, a private sector organization formed in 1979 for the purpose of enhancing public safety by providing a national forum to foster improved seismic safety provisions for use by the building community.

The assessment of the Tentative Provisions was performed using the committee structure shown in figure 1. Nine Technical Committees were formed with interests that collectively cover the Tentative Provisions. The Joint Committee on Review and Refinement consists of all voting members of the Technical Committees. The chairmen of the Technical Committees form a Coordinating Committee.

Membership of each Technical Committee is made up of representatives of organizations that have particular interest in the Tentative Provisions; the participants are listed in the committee membership section of this report.

In addition to the voting members, each Technical Committee includes a non-voting member from each of the following organizations: The Applied Technology Council (ATC), the Building Seismic Safety Council (BSSC) and the National Bureau of Standards (NBS). The ATC representative served as a technical resource to the committee since he was closely involved with the development of the provisions of interest to the committee. The NBS representative was the technical secretary throughout the effort. The BSSC representative provided a link with the Building Seismic Safety Council, which will be involved in trial designs and evaluations.

1.2 Committee Summary

Technical Committee 6 had the responsibility of reviewing and recommending revisions to Chapter 10, Steel, of the Tentative Provisions for the Development of Seismic Regulations for Buildings (ATC 3-06). The committee is comprised of six voting and three nonvoting members, drawn from industry, professional organizations, standard development organization and governmental agencies. The first of three meetings which the committee had was held on December 11, 1978 at the National Bureau of Standards, Gaithersburg, Maryland in conjunction with the organizing meeting. The second meeting

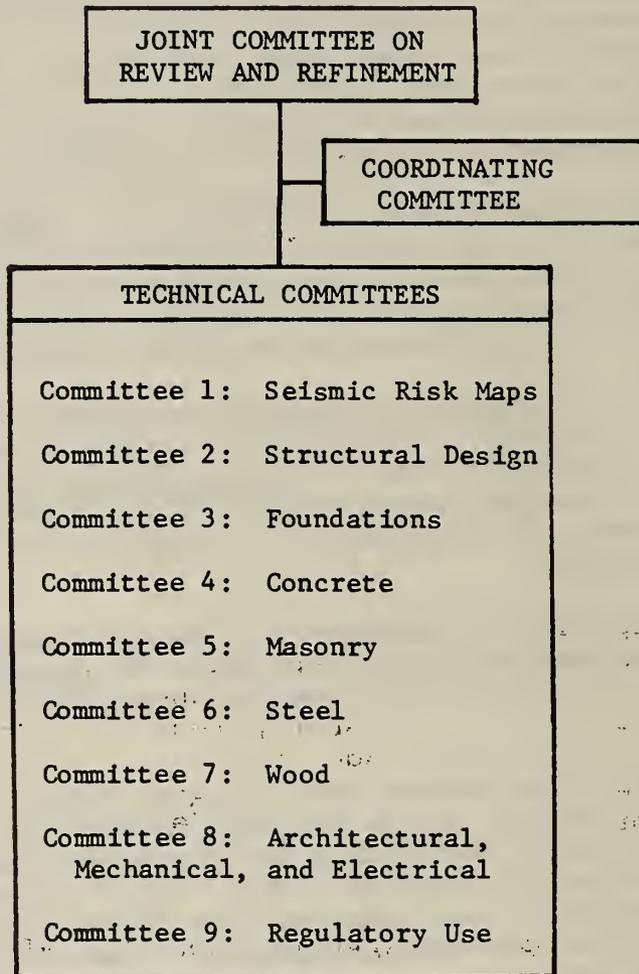


Figure 1: Committee Structure

was held on February 13, 1980 in Washington, D.C. The third meeting was held in conjunction with the Joint Committee meeting which was held on July 16, 1980 at the National Bureau of Standards. A brief summary of the actions taken at each of these meetings is presented below.

At the first meeting, Mr. Jerome S. B. Iffland was elected as chairman and Mr. William A. Sontag was appointed to serve as the committee's representative to Technical Committee 2, Structural Design. The committee expressed the intention of concentrating its efforts on the review and refinement of Chapter 10 and that it will also comment on those provisions relevant to Chapter 10.

In order to obtain the widest possible participation from all interest parties in the committee's effort, it was agreed that individual members of the committee would contact professional and trade organizations. Specifically, these organizations were asked to submit written comments to the committee and, in addition, their representatives were invited to attend scheduled meetings of the committee.

Although the schedule of the second meeting was announced in several national professional publications and personal contacts which were made by individual committee members, the meeting was attended only by the members and their alternates. At this meeting, the committee addressed all provisions of Chapter 10 with specific reference to written comments which were submitted to the committee prior to the meeting and responses to these comments which were prepared by Mr. Clarkson W. Pinkham, the ATC representative.

In reviewing each of the provisions, the committee introduced the state-of-the-art information, carefully deliberated and incorporated into the revision where appropriate. It was emphasized that the proposed revision to the ATC 3-06 document will be used in trial designs for the economic impact assessment.

Review of the provisions in Chapter 10 was completed during the first day of the two-day scheduled meeting to the satisfaction of all who attended the meeting. The committee agreed to vote on each of the provisions separately. A ballot was distributed to six voting members on April 22, 1980. Extensive review comments were distributed by Mr. Charles DeMaria, representing the Building Seismic Safety Council (BSSC) on the committee, to the committee members on March 24, 1980. His comments were reflected in the voting. By July 1, 1980, the secretariat had received five ballots out of six voting members.

2.0 Committee Actions

2.1 Recommendations for Change

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.2.1

Delete 10.2.1 (B)

Change present 10.2.1 (C) and 10.2.1 (D) to 10.2.1 (B) and 10.2.1 (C), respectively.

Add new 10.2.1 (D)

In AISC specifications 2.5, substitute $V_u \leq 0.68$ in lieu of $V_u \leq 0.55$.

FINAL BALLOT: 5 YES
0 NO
0 ABSTAIN
1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

Deletion of 10.2.1 (B) is to prevent the use of Eq. (2.5-1) of part 2, AISC Specs. which limits the maximum allowable shear to $(0.55 F_y) t_d$. The committee recommends that the maximum allowable shear be increased to $(0.68 F_y) t_d$.

Addition of sec. 10.2.1 (D) reflects this recommendation.

This is also to be consistent with the proposed AISC specifications.

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.2

Change the seventh and eighth line to read as follows:

"...members or structural systems."

"Connections which do not develop the strength of the member or structural systems..."

FINAL BALLOT: 5 YES
0 NO
0 ABSTAIN
1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

These changes reflect the cases where members need not develop the full capacity of their cross section.

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.4

Delete sec. 10.4.1

Change sec. 10.4.1 to sec. 10.4.1 and to read as follows: "Ordinary moment frames, space frames in building frame systems, and space frames incorporated in bearing wall systems shall be designed and constructed in accordance with Ref. 10.1, Part 1 or Ref. 10.2 or Ref. 10.3."

FINAL BALLOT: 5 YES
0 NO
0 ABSTAIN
1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

Combine two separately stated requirements into one.

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.5.1

Change the "exception" to read as follows:

1. Moment frames in one- and two-story buildings assigned to Seismic Performance Category C may be Ordinary Moment Frames.
2. Moment frames in one-story building assigned to Seismic Performance Category D may be Ordinary Moment Frames.

FINAL BALLOT: 5 YES
 0 NO
 0 ABSTAIN
 1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

One-story steel frame buildings have performed well during earthquakes. Addition of "Exception 2" reflects these case histories, and the intent of sec. 3.3.4 and 3.3.5.

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.6.5

Change the first line after the equation to read as follows:

"in place of Equation 1.15-2 of Ref. 10.1."

FINAL BALLOT: 5 YES
0 NO
0 ABSTAIN
1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

The committee felt that the present equation is too complicated, and a simpler form is desired. However, the committee agreed to retain the equation in its present form, and examine its impact during the trial design phase. Because the way in which the equation was derived, the equation should replace only AISC Eq. 1.15-2 which is concerned with buckling of the column web.

REVIEW AND REFINEMENT OF TENTATIVE SEISMIC PROVISIONS

PROPOSED CHANGE

TECHNICAL COMMITTEE: # 6, Steel

COMMITTEE ITEM NUMBER: _____

ATC-3-06 SECTION REFERENCE: 10.6.3

Change the third line to read "axial force in the columns shall not exceed $0.75P_y$."

FINAL BALLOT: 3 YES
2 NO
0 ABSTAIN
1 DID NOT VOTE

COMMENT ON PROPOSED CHANGE:

Modifying the 0.6 factor to 0.75 was to reflect the change in the AISC specifications (1979). Since the 1979 AISC specs. has already incorporated the 0.75 factor, this item should be deleted (Pinkham's letter of April 24, 1980). It has been suggested that this factor be kept as 0.6 and evaluate its impact by trial designs.

2.2 Recommendations for Trial Design

The committee recommends that the following items be evaluated in trial designs:

1. The limitation of the axial force in column to $0.6 F_y$ and to $0.75 F_y$ (see Mr. Pinkham's letter of April 24, 1980).
2. The use of the equation in sec. 10.6.5 for a minimum web thickness to be stiffened.
3. The effect of drift limitation on the economy of steel frame structures (see Mr. De Maria's letter of March 24, 1980).

3.0 Committee Records

3.1 Minutes of Meeting

The minutes of each of the three committee meetings are included in this report immediately following this page.

Minutes

Technical Committee 6: Steel

December 11, 1979

Room A434, National Bureau of Standards

1.0 Call to Order

The Secretary of the task committee, H. S. Lew, serving as a temporary chairman called the meeting to order at 11:10 a.m. The secretary briefly reviewed the agenda of the meeting.

2.0 Introduction of Members

Individual members introduced themselves and identified their affiliation. The following representatives were present:

<u>Name</u>	<u>Representative of</u>
Frederick J. Palmer	American Institute of Steel Construction
William H. Smith	American Iron and Steel Institute
Jerry Iffland	American Society of Civil Engineers
John B. Scalzi	Interagency Committee on Seismic Safety in Construction
William A. Sontag	Metal Building Manufacturers Assoc.
Norman K. Cohn	Steel Plate Fabricators Assoc.
Clarkson Pinkham	Applied Technology Council
H. S. Lew	National Bureau of Standards

It was noted that TC 6 did not have a representation from the Building Seismic Safety Council.

No visitors attended the meeting.

3.0 Selection of Chairman

Fred Palmer nominated Jerry Iffland for chairman and was seconded by Norman Cohn.

By acclamation Jerry Iffland was elected as chairman.

The meeting was turned over to the new chairman.

4.0 Appointment of TC 6 Representative to TC 2

William Sontag was appointed and agreed to serve as TC 6 representative to TC 2.

5.0 Selection of Date for Working Meeting

Date: February 13, 1980 (9:00 a.m. - 5:00 p.m.)
February 14, 1980 (9:00 a.m. - 4:00 p.m.)

Location: Washington, D. C.

Jack Scalzi will assist in locating meeting place.

6.0 Invitation to the February Working Meeting

The secretary mentioned that the date and location of the February meeting will be announced through the ASCE, NIBS and NCSBCS newsletters.

The members agreed that it would be desirable to invite specific groups in addition to the public announcement. Invitation will be extended to participate in the working meeting:

ASCE Structural Division by Iffland
AISI Technical Committees by Smith
AISC Technical Committees by Palmer
AWS Technical Group by Smith
Res. Council on Structural Connections by Palmer
Steel Deck Institute by Smith
Steel Joist Institute by Palmer
Structural Stability Res. Council by Iffland
Council on Tall Buildings and Urban Habitat by Iffland

7.0 Report from TC 2

Bill Sontag reported that two individuals are nominated for chairman and vice chairman. They are Howard Simpson, who represents ANSI and Hal Iyengar who represents ASCE. Depending upon their availability, TC 2 will select their chairman.

8.0 Deliberation of Comments

The committee agreed that only those comments relevant to Chapter 10 will be discussed in TC 6. Those comments raised in TC 2 which are closely related to Chapter 10 will be discussed in TC 6.

9.0 Possible Topics of Refinements in Chapter 10

9.1 Summary of Chapter 10 of ATC-3

Clarkson Pinkham summarized the salient features of Chapter 10.

- o Chapter 10 of ATC-3 deals with six specifications

AISC

AISI - cold-formed steel

AISI - cold-formed stainless steel

SJI - open web joists

SJI - long-span joists

AISI - steel cables for buildings

- o Specific modifications to the current AISC specification was summarized to reflect the strength design approach in ATC-3.

9.2 Specific Comments Made by the Committee Members

- o Exclusion of one-story buildings for use as essential facility (category D) which do not meet compact shape and bracing requirement. (Refer to Sect. 10.5.1)
- o Full strength requirement for connections and ambiguity related to load requirements
- o Eccentric braced frame not being covered in ATC-3
- o Drift requirement for one-story industrial buildings
- o Dates for specifications cited as reference
- o Design for overturning for high-rise buildings (raising of forces vs. modification of dead load of structure)

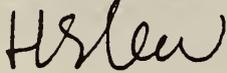
10.0 Comments by the NBS Secretariat

- o NBS secretariat will send out mailing labels to the TC 6 members for their use in mailing of comments to the TC 6 members.
- o The secretary requested that in order to save time, all comments on chapter 10 should be sent to the NBS secretariat, to the ATC representative and to the other members of TC 6.
- o NBS secretariat will make a limited number of ATC-03 copies available to those who wish to participate in the February meeting.

11.0 Adjournment

There being no further items before the committee, the meeting adjourned at 3:45 p.m.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "H. S. Lew".

H. S. Lew, Secretary

Minutes
Technical Committee 6: Steel
February 13, 1980
Room 338, 1800 G Street, N.W.
Washington, D.C.

1.0 Call to Order

Chairman Iffland called the meeting to order at 9:00 a.m. This is the first of a two-day open meeting scheduled for the committee to deliberate on the issues submitted to the committee by individuals prior to the meeting.

2.0 Attendance

<u>Name</u>	<u>Representative of</u>
N. K. Cohn	Steel Plate Fabricators Association
D. S. Ellifrit	Metal Building Manufacturers Association
J. S. B. Iffland	American Society of Civil Engineers
A. L. Johnson	American Iron and Steel Institute
H. S. Lew	National Bureau of Standards
C. W. Pinkham	Applied Technology Council
J. B. Scalzi	Interagency Committee on Seismic Safety in Construction
W. H. Smith	American Iron and Steel Institute
W. A. Sontag	Metal Building Manufacturers Association

Chairman Iffland noted that Mr. William Milek will replace Mr. Fred Palmer for AISC representation. He also noted that Mr. Charles De Maria has been designated as the representative of the Building Seismic Safety Council.

3.0 Review of ATC 3-06

The secretary reported that specific written comments that have been sent to NBS have been distributed to the committee members and the written responses to these comments by the ATC representative have also been sent to the members by Mr. Pinkham.

It was agreed that the committee review all provisions in Chapter 10 on an item-by-item basis. In reviewing the provisions, the committee also made reference to the comments made by Mr. De Maria dated March 11, 1977.

Sec. 10.1.: It was noted that the references 10.1 through 10.6 need to be updated reflecting the latest versions of documents. It was also recommended that the reference numbering system be changed from Ref 10.1, etc. to Ref 10-1, etc.

Sec. 10.2.: For the cases of $\phi = 0.90$ and $\phi = 0.67$, it was agreed that "or structural system" be added to the existing statements so that they be read as "Members and connections which develop the strength of the members or structural systems" and "connections which do not develop the strength of the member, the structural system or do not conform to Sec. 10.6.1(A)6."

10.2.1 Delete (B) - This is to prevent the use of Part II the current AISC specs. for determining shear strength. It is also to be consistent with the proposed AISC specs.

Change (C) to (B)

Change (D) to (C)

Add new (D) In AISC Sec. 2.5 Substitute " $V_u \leq 0.68$ " in lieu of " $V_u \leq 0.55$ "

10.2.2 Add a comma to read "... AISI Sec. 2.1.2.2 of Ref. 10.2, and AISI Sec. 3.9.1 ..."

10.2.3 No change

10.3 No change

10.4.1 Delete

10.4.2 Change 10.4.2 to 10.4.1 and change the statement to read as follows: "Space frames in building frame systems and systems with ordinary moment frames or where incorporated ... in accordance with Ref. 10.1, Part 1 or Ref. 10.2 or Ref. 10.3."

10.5.1 Modify the exception to read as follows:

"EXCEPTION:

1. Moment frames in one-and two-story buildings assigned to Seismic Performance Category C may be Ordinary Moment Frames.
2. Moment frames in one-story buildings assigned to Seismic Performance Category D may be Ordinary Moment Frames."

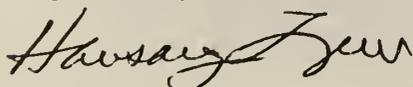
10.5.2 No change

- Sec. 10.6
1. No change
 2. Change ASTM designations to reflect the latest versions.
 3. Change the statement to read "... exceed $0.75 P_y$ " instead of "... exceed $0.60 P_y$."
 4. No change
 5. Change the sentence after the equation to read "in place of Equation 1.15-2 of Ref. 10.1."
 6. Change the statement to read " Beam to column connected in special moment frames shall develop..."
 7. Change the statement to read: "Change the start of the second paragraph on Page-5-62-in of AISC Sec. 2.9..."

4.0 Adjournment

There being no further items before the committee, the meeting was adjourned at 3:30 p.m.

Respectfully submitted,



H. S. Lew, Secretary

Minutes
Technical Committee 6: Steel
July 16, 1980
National Bureau of Standards
Washington, DC

- 1.0 The meeting was called to order by acting chairman William Sontag at 5:30 p.m.
- 2.0 Those in attendance were: N. K. Cohn 2 visitors.
C. W. Pinkham
W. A. Sontag
W. Milek
A. L. Johnson
C. DeMaria
H. S. Lew
W. H. Smith
Jack Scalzi
- 3.0 Bill Smith made a request to the committee for a time slot for his presentation on the eccentric braced frame system before the joint committee. Smith introduced, in his letter of January 11, 1980, and at the February 13, 1980 meeting, the eccentric braced frame systems for committee consideration as an item for possible inclusion in the revision process of ATC 3-06. At the February meeting it was decided that this issue be tabled due to the lack of criteria available for the application of the eccentric braced frame system. At the present meeting, Bill Smith distributed a subcommittee report on this system prepared by the Structural Engineers Association of Northern California's Subcommittee on Eccentric Braced Frame and recommendations to incorporate it in the ATC 3 document prepared by the American Iron and Steel Institutes' Committee on Construction Codes and Standards.

In the discussion that followed, it was pointed out that at the present time it would not be possible to consider the inclusion of the eccentric brace frame system in trial designs due primarily to the fact that no bench mark criteria are available to which the new system can be compared.

A motion was made by William Milek and seconded by Jack Scalzi that Committee 6, Steel, recommend that the relative merits of the eccentric braced frame system be evaluated and considered for inclusion in "the final resource document by BSSC." The motion was carried unanimously.

The committee further recommended that the committee representatives to Committee 10A (Sontag and Smith) express its view that the eccentric braced frame system as a special item be considered as a candidate for trial design.

The committee agreed that a ten minute slot be allocated for Bill Smith to make his presentation on the eccentric braced frame system.

The meeting was adjourned at 6:30 p.m.

Respectfully submitted,

A handwritten signature in cursive script that reads "H. S. Lew". The letters are fluid and connected, with a prominent loop at the end of the word.

H. S. Lew, Secretary

3.2 Committee Roster

COMMITTEE 6: Steel

American Institute of Steel Construction

William A. Milek
American Institute of Steel Construction, Inc.
Wrigley Building
400 North Michigan Ave.
Chicago, ILL 60611

Phone: 312-670-2400

American Iron and Steel Institute

Dr. Albert L. Johnson
Staff Representative
American Iron and Steel Institute
1000 16th Street, N.W.
Washington, D.C. 20036

Phone: 202-452-7184

Alter: Mr. William H. Smith
Regional Director
American Iron and Steel
Institute
Latham Square Building
508 Sixteenth Street
Suite 704
Oakland, CA 94612

Phone: 415-763-6751

American Society of Civil Engineers

Mr. Jerry Iffland (Chairman)
Iffland, Kavanagh, Waterbury
1501 Broadway
New York, New York 10036

Phone: 212-933-2000

Interagency Committee on Seismic Safety in Construction

Mr. John B. Scalzi
National Science Foundation
Room 1130
1800 G Street N.W.
Washington, D.C. 20550

Phone: 202-632-0648

Committee 6 (continued)

Metal Building Manufacturers Association

Mr. William A. Sontag
Pascoe Steel Corporation
P. O. Box 2628
Pomona, CA 91766

Phone: 714-623-1411

(representative to Committee 2)

Alter: Duane Ellifrit
Director of Research &
Engineering
Metal Building Manufacturers
Assoc.
1230 Keith Building
Cleveland, OH 44115

Steel Plate Fabricators Association

Mr. Norman K. Cohn
Chief Engineer
Mississippi Valley Structural Steel Co.
Sub. of Bristol Steel & Iron Works
3117 Big Bend Blvd.
St. Louis, MO 63143

Phone: 314-644-2200

Applied Technology Council

Mr. Clarkson Pinkham
President, S B Barnes Assoc.
2236 Beverly Blvd.
Los Angeles, CA 90057

Phone: 213-382-2385

Building Seismic Safety Council

Mr. Charles De Maria
Building Seismic Safety Council
H. J. Brunnier Associates
Structural Engineers
55 New Montgomery Street
Suite 608
San Francisco, CA 94105

Phone: 415-781-0370

Committee 6 (continued)

National Bureau of Standards

Dr. H. S. Lew
Secretariat
Committee 6, Steel
National Bureau of Standards
Rm. B-168, Bldg. 226
Washington, D.C. 20234

Phone: 301-921-2647

3.3 Selected Committee Correspondence and Applied Technology Council Comments

March 17, 1980

Mr. Gerald Ifland
Chairman, Committee 6 - Steel
Ifland, Kavanaugh, Waterbury, P.C.
1501 Broadway
New York, NY 10036

Dear Mr. Ifland:

Mr. William Smith of AISC has asked me to send you these more detailed versions of my comments on Chapter 10 of the ATC 3-06 Document.

Comment 1

Section 10.1, Reference Documents: The latest versions of documents should be given in this list. The 1978 Edition of the AISC Specifications has been published since the formation of the original list in this section.

Comment 2

Design Provisions for Braced Steel Frames: Braced Frame provisions in the Recommended Lateral Force Provisions of SEAOC required that "all members in braced frames shall be designed for 1.25 times the force due to the specified base shear.

I cannot locate an equivalent provision for this extra factor of 1.25 in the ATC 3-06 provisions; neither in the ϕ factor nor in the R factor.

Comment 3

Control on the net area of bolted bracing connections: The commentary to Section 1.5.1.1 of the 1978 AISC Specifications (page 105) states that the net to gross area ratio:

$$A_e/A_g \geq F_y/0.833F_u$$

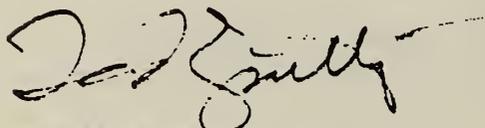
So as to provide general yielding rather than fracture of net area.

It is most necessary that this area ratio, or a more conservative equivalent, be required for connections in seismic resistant braced frames.

March 17, 1980
Mr. Gerald Ifland
Page 2

In general, all provisions should be reviewed (for example, the tensile capacities of threaded areas of bolts) so as to assure that a substantial amount of yielding deformation can occur before fracture or sudden failure of an element or connection. The safety factor against fracture should be 3 to 5 rather than the value of 2 given in the AISC Section 1.5.1.1 Commentary.

Sincerely yours,



Theodore Zsutty
Professor of Civil Engineering
Chairman, Seismology Committee
Structural Engineers Association of California

TZ:cm

cc: Dr. H. S. Lu, Secretary
Committee 6 - Steel

S. B. BARNES AND ASSOCIATES

CONSULTING STRUCTURAL ENGINEERS

2236 BEVERLY BOULEVARD

LOS ANGELES, CALIFORNIA 90057

382-2385

CLARKSON W. PINKHAM
ROBERT W. SPRACKLEN

S. B. BARNES
JOHN HOEFT
ALBIN W. JOHNSON

April 24, 1980

Mr. Jerone S. B. Iffland
Iffland Kavanagh Waterbury, P.C.
Architects-Engineers
1501 Broadway
New York, New York 10036

Dear Jerry:

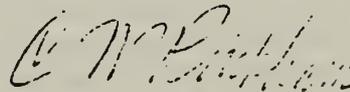
I am not a voting member of the Committee but I do have one "bone" to pick with one item on the ballot from H. S. Lew.

The item in Sec. 10.6.3 was an item discussed in the letter from Charles DeMaria but I do not recall the item being discussed in Washington. If it was decided to modify the 0.6 factor to 0.75 the item should be deleted because that is already given in that manner in AISC-79 (Sec. 2.3.2.)

As for the merits of the change, I concur with C. De Maria that the 0.75 factor would be appropriate for those columns which are not depended on to provide the primary stability of the building. For the reasons given on page 442 of ATC-3-06, I do feel that 0.6 factor is important to keep for those columns providing the primary lateral stability to the structure. For this reason I could recommend a modification to the current ATC provision but not a deletion.

Even if it were chosen as a final matter to delete this provision, I feel it should remain as is so that the design office check could see how serious the problem described by C. DeMaria actually is.

Very truly yours,


C. W. Pinkham

CWP:ls

cc: W. A. Milek
A. L. Johnson
W. H. Smith
J. B. Scalzi
W. A. Sontag
D. Ellifrit
N. K. Cohn
H. S. Lew
C. DeMaria

H. J. BRUNNIER ASSOCIATES
STRUCTURAL ENGINEERS

55 NEW MONTGOMERY STREET - SUITE 608 - SAN FRANCISCO, CALIFORNIA 94105 - 415 781-0370

H. J. BRUNNIER 1982 - 1971

H. C. POWERS
H. L. LYELL
C. D. DE MARIA
S. E. TEIXEIRA
A. P. STEVENS

March 24, 1980

TO: Members of NSB ATC-3 Technical Committee 6

J. S. Iffland, Chairman
F.J Palmer
A. L. Johnson
W. H. Smith, Alternate
J. B. Scalzi
W. A. Sontag
D. Ellifrit, Alternate
N. K. Cohn
E. Pinkham
H. S. Lew, Secretary

Gentlemen:

Enclosed are comments on the steel chapter and related sections of ATC-3-06. The lateness of submission is a result of my late appointment to the committee.

Sincerely yours,



Charles De Maria
Building Seismic Safety Council

enclosures

CDD/ng

REVIEW OF THE STEEL SECTIONS OF ATC 3-06
TENTATIVE PROVISIONS FOR THE DEVELOPMENT OF
SEISMIC REGULATIONS FOR BUILDINGS

March 19, 1980

GENERAL COMMENTS

The purpose of the present review of ATC 3-06 is to discover and eliminate any obvious errors and inconsistencies in the document prior to a program of testing the provisions with trial designs of a broad spectrum of building types and configurations. The trial designs may bring to light the need for further modification of the provisions in order to produce structures comparable with those which have been observed to perform satisfactorily in past earthquakes or in order to allow for a more economical use of construction materials. Following the trial designs, it is absolutely essential that a review and evaluation of the results and any necessary changes in the provisions be made prior to their adoption as a model code. In the event of adoption of the provisions as a code it is also essential that an organization and procedure be established to correct and update the code as further experience with its application and advances in seismic resistant design necessitate.

Of prime concern to the steel industry is the effect that drift limitation criteria will have on the economy of steel frame structures. This effect should be carefully evaluated in the trial designs. We recommend that story drift limitations be carefully re-evaluated and that no stricter limitations be set than those required to provide a reasonable degree of protection for finish materials. We further recommend that consideration be given to the elimination of drift limitation requirements for structures without brittle finish materials.

ATC 3-06 does not mention a type of structural steel system, the eccentric braced frame, which is undergoing rapid development and acceptance as an economical seismic resistant system. We recommend that trial designs include this system and that it be incorporated into the final document, together with the proper criteria for its use.

The seismic response modification coefficient, R, for special reinforced concrete moment frames appears high when compared with the similar value for special structural steel frames. Work at the University of California involving cyclic loading at high strain levels suggest a greater differentiation between the two materials. Special concrete frames are highly rated even though we have little data on the behavior of such construction during severe earthquakes and know that the practical problems of designing, detailing and placing the required reinforcement are so great that the designs must be compromised during the construction period. We recommend a greater differentiation between the R values for special steel and reinforced concrete moment frames in recognition of the superior materials, workmanship and past performance of structural steel frames.

In general, the provisions of ATC 3-06 which affect the use of steel are consistent with the philosophy of the document. This philosophy involves the application of realistic seismic forces and utilization of member capacities to resist those forces. Severe drift limitation criteria however, may prevent the full utilization of member capacities. Specific comments on the detailed provisions follow.

COMMENTS ON THE DETAILED PROVISIONS OF ATC 3-06

1.6.2(F) This paragraph is unduly restrictive. Continuous Special Inspections should be limited to welds determined to be critical by the person responsible for the structural design. Credit should be given to "Approved Fabricators" participating in the AISC Quality Certification Program. The standards for special inspections such as the AWS D1.1 Structural Welding Code and the Research Council Specification for Structural Joints using ASTM A325 or A490 Bolts should be cited.

1.6.3(D)2 Ultrasonic testing of partial penetration groove welds is meaningless and should be deleted. Visual inspection of the root pass is the most reliable method of insuring quality.

10.1 The reference documents should be updated to the most recent editions. Additional references to AWS D.1.1 Structural Welding Code, AWS D.1.3 Specification for Welding Sheet Steel, and the Research Council Specification for Structural Joints using ASTM A325 or A490 Bolts should be included.

10.2 It is not clear how the strength of members which have flange end connections utilizing high strength bolts should be computed. Is reduction of flange area up to 15% ignored as per Reference 10.1 Section 1.10.1, or is the entire assembly penalized by requiring a capacity reduction factor of 0.67?

page three

10.2 (cont'd) The capacity reduction factors should be re-evaluated, considering the reliability of steel and the fact that the factors are based on the specified minimum yield point which is generally exceeded.

The reference to Section 10.6.1(A)6 should be corrected to read "Section 10.6, Item 6".

10.5.1 The limitation of Ordinary Moment Frames to one and two story buildings in Performance Category C and their prohibition in Performance Category D is contrary to the Provisions of Sections 3.3.4 and 3.3.5 which permit their use up to a height of 160 feet for Category C and up to a height of 100 feet for Category D. It is our opinion that Sections 3.3.4 and 3.3.5 represent the intention of ATC-06 with the higher loadings resulting from the lower R value for Ordinary Moment Frames reducing the need for post elastic performance. In any event, Ordinary Moment Frames should be permitted for one-story performance Category D structures.

10.6, Item 1 The modifications to Part 2 of ref. 10.2 make difficult reading, however, it appears that the compact section and lateral bracing of compression flange requirements of Part 2 are applicable to Special Moment Frames. We are in agreement with these requirements.

10.6, Item 3 Limiting the axial force in columns to 0.60 times yield creates almost insoluble problems in the design of corner columns of tall buildings with high overturning moments and the requirement for orthogonal combinations. High strength steels are not permitted, and simply increasing the size of corner columns will not work as differential shortening of corner columns will introduce huge gravity moments and dishing of floors under vertical loading. We recommend "The axial force in the columns shall not exceed $0.75 P_y$ ".

10.6, Item 4 The term "plastic capacity of the joint" needs further definition. Is it the sum of the beam capacities proportioned to the column above and the column below, or is it the more unlikely combination of the sum of the beam capacities plus the column above applied to the column below? It is not clear for conditions A and B if vertical load is considered in either the plastic moment capacity of the joint or the strength of the column splice.

10.6, Item 5 The intent of requiring the panel zone to resist shears due to deforming the frame 2 times that resulting from the prescribed forces is not clear. If the intent is to prevent the initial hinge from being due to shear yielding in the panel zone, this is not necessarily beneficial. High ductility factors of steel frames are merited in part due to shear yielding in the panel zone without loss of stability.

10.6, Item 5 (cont'd) The Chen-Newlin formula for critical crippling stress on a column web was developed from load tests on a small number of rolled wide flange sections in the 8" to 12" range. The authors concluded that significant yielding of the web opposite the load was a "local problem" not affecting the buckling strength of the web and dismissed this factor from further consideration. ATC 3-06 should not dismiss this factor, for the significant yielding of the column web will permit the beam to rotate without developing its plastic moment. If we accept the Chen-Newlin formula for critical crippling stress on a column web, and accept the parabolic combination with shear stresses as proposed in the commentary, and neglect entirely the axial load stress in the column, then the formula might be substituted for the Equation 1.15-2 of ref. 10.1, but should not be substituted for Equation 1.15-1. Use of the above formula alone will permit thinner webs without load stiffeners than Equation 1.15-1 which is already unconservative in that its use allows some inelastic deformation at the working stress level. In view of the complexity and uncertainties involved in the formula presented, we recommend that a simpler formula or procedure be devised to control joint panel zone thickness.

10.6, Item 6 The same questions concerning the method of computing member strength raised by Section 10.2 apply to this item.

C.3.3.3 This section should be amplified to permit the use of moment frames to resist forces in the direction of one axis of the structure and braced frames to resist forces in the direction of the other axis of the structure. We believe that this is the intent of ATC 3-06, however, the issue is clouded by use of the term "three-dimensional space frame" in Section C.3.3.1.

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5. AUTHOR(S) H. S. Lew			
6. PERFORMING ORGANIZATION <i>(If joint or other than NBS, see instructions)</i> NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234		7. Contract/Grant No.	8. Type of Report & Period Covered Final
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10. SUPPLEMENTARY NOTES <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.			
11. ABSTRACT <i>(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)</i> The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the steel design provisions. The committee made 6 recommendations for revisions to the Tentative Provisions and three additional recommendations. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.			
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